Syllabus

PHYSICS
(UG courses)
Admitted Batch 2008 -2009

Andhra University

May 2008
A.P. State Council of Higher Education
Subject Committee

1. Prof. T. Bhaskar Rao, Coordinator
   Dept. of Physics, Kakatiya University

2. Prof. M. Laxmipathi Rao,
   Dept. of Physics, Osmania University

3. Prof. V. V. R. Narsimha Rao,
   Dept. of Physics, S.V. University

4. Prof. N. Veeraiah,
   Dept. of Physics, Acharya Nagarjuna University

5. Prof. R. Ramakrishna Reddy,
   Dept. of Physics, Srikrishnadevaraya University

6. Prof. N. Gopi Krishna,
   Dept. of Physics, Kakatiya University

7. Dr. K. Krishna Kumar,
   Pingle Govt. College for Women, Warangal

8. Dr. Y. Gowri Sankar,
   Dept. of Physics, Hindu College, Guntur

9. Dr. B. Nagaiah,
   Dept. of Physics, LB College, Warangal
### B.Sc. Courses (Structure)

#### First year:

<table>
<thead>
<tr>
<th>S.no.</th>
<th>Subject</th>
<th>Hrs per week</th>
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<tbody>
<tr>
<td>1.</td>
<td>English language including communication skills</td>
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<tr>
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<tr>
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<td>6.</td>
<td>Core1-lab I</td>
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**Total** 36

#### Second year:

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**Total** 37

#### Third year:

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**Total** 39
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<tr>
<th>YEAR</th>
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<tr>
<td>FIRST</td>
<td>Theory – I</td>
<td>Mechanics and Waves and</td>
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<td>Oscillations</td>
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<td></td>
<td>Practical - II</td>
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<td>THIRD</td>
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<td>Theory - IV</td>
<td>Modern Physics</td>
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<td>Practical - III</td>
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<td>3</td>
</tr>
<tr>
<td></td>
<td>Practical - IV</td>
<td>---</td>
<td>3</td>
</tr>
</tbody>
</table>
Unit – I
1. **Vector Analysis (10):**

2. **Mechanics of Particles(10)**
   Laws of motion, motion of variable mass system, motion of a rocket, multi-stage rocket, conservation of energy and momentum. Collisions in two and three dimensions, concept of impact parameter, scattering cross-section, Rutherford scattering

3. **Mechanics of rigid bodies(10)**
   Definition of Rigid body, rotational kinematic relations, equation of motion for a rotating body, angular momentum and inertial tensor. Eulers equation, precession of a top, Gyroscope, precession of the equinoxes

Unit – II
4. **Mechanics of continuous media(8)**
   Elastic constants of isotropic solids and their relation, Poisson’s ratio and expression for Poisson’s ratio in terms of y, n, k. Classification of beams, types of bending, point load, distributed load, shearing force and bending moment, sign conventions, simple supported beam carrying a concentrated load at mid span, cantilever with an end load

5. **Central forces(12)**
   Central forces – definition and examples, conservative nature of central forces, conservative force as a negative gradient of potential energy, equation of motion under a central force, gravitational potential and gravitational field, motion under inverse square law, derivation of Kepler’s laws, Coriolis force and its expressions.

6. **Special theory of relativity (10)**
   Galilean relativity, absolute frames, Michelson-Morley experiment, Postulates of special theory of relativity. Lorentz transformation, time dilation, length contraction, addition of velocities, mass-energy relation. Concept of four vector formalism.
7 **Fundamentals of vibrations**(12)

Simple harmonic oscillator, and solution of the differential equation– Physical characteristics of SHM, torsion pendulum, - measurements of rigidity modulus , compound pendulum, measurement of ‘g’, combination of two mutually perpendicular simple harmonic vibrations of same frequency and different frequencies, Lissajous figures

8 **Damped and forced oscillations**(12)

Damped harmonic oscillator, solution of the differential equation of damped oscillator. Energy considerations, comparison with undamped harmonic oscillator, logarithmic decrement, relaxation time, quality factor, differential equation of forced oscillator and its solution, amplitude resonance, velocity resonance

9 **Complex vibrations**(6)

Fourier theorem and evaluation of the Fourier coefficients, analysis of periodic wave functions-square wave, triangular wave, saw-tooth wave

**Unit – IV**

10 **Vibrations of bars**(12)

Longitudinal vibrations in bars- wave equation and its general solution. Special cases (i) bar fixed at both ends ii) bar fixed at the mid point iii) bar free at both ends iv) bar fixed at one end. Transverse vibrations in a bar- wave equation and its general solution. Boundary conditions, clamped free bar, free-free bar, bar supported at both ends, Tuning fork.

11 **Vibrating Strings**(12)

Transverse wave propagation along a stretched string, general solution of wave equation and its significance, modes of vibration of stretched string clamped at both ends, overtones, energy transport, transverse impedance

12. **Ultrasonics**(6)

Ultrasonics, properties of ultrasonic waves, production of ultrasonics by piezoelectric and magnetostriction methods, detection of ultrasonics, determination of wavelength of ultrasonic waves. Velocity of ultrasonics in liquids by Sear’s method. Applications of ultrasonic waves.

**NOTE:** Problems should be solved at the end of every chapter of all units.
Textbooks

4. *First Year Physics* - *Telugu Academy*.

Reference Books

ANDHRA UNIVERSITY
PHYSICS SYLLABUS ACADEMIC YEAR 2009-10

B.Sc. (Physics)
Theory Paper – II
Thermodynamics and Optics

Unit – I  30 hrs

1. **Kinetic theory of gases: (8)**


2. **Thermodynamics: (12)**


3. **Thermodynamic potentials and Maxwell’s equations: (10)**


Unit – II  30 hrs

4. **Low temperature Physics: (10)**


5. **Quantum theory of radiation: (10)**

   Black body-Ferry’s black body – distribution of energy in the spectrum of Black body – Wein’s displacement law, Wein’s law, Rayleigh-Jean’s law – Quantum theory of radiation - Planck’s law – deduction of Wein’s law, Rayleigh-Jeans law,
from Planck’s law - Measurement of radiation – Types of pyrometers –
Disappearing filament optical pyrometer – experimental determination – Angstrom
pyroheliometer - determination of solar constant, effective temperature of sun.

6. **Statistical Mechanics: (10)**

Introduction to statistical mechanics, concept of ensembles, Phase space, Maxwell-
Boltzmann’s distribution law, Molecular energies in an ideal gas, Bose-Einstein
Distribution law, Fermi-Dirac Distribution law, comparison of three distribution
laws, Black Body Radiation, Rayleigh-Jean’s formula, Planck’s radiation law,
Weins Displacement, Stefan’s Boltzmann’s law from Plancks formula. Application
of Fermi-Dirac statistics to white dwarfs and Neutron stars.

**Unit III**

30 hrs

7 **The Matrix methods in paraxial optics: (8)**

Introduction, the matrix method, effect of translation, effect of refraction, imaging
by a spherical refracting surface. Imaging by a co-axial optical system. Unit

8 **Aberrations: (7)**

Introduction – Monochromatic aberrations, spherical aberration, methods of
minimizing spherical aberration, coma, astigmatism and curvature of field,
distortion. Chromatic aberration – the achromatic doublet – Removal of chromatic
aberration of a separated doublet.

9 **Interference: (15)**

Principle of superposition – coherence – temporal coherence and spatial coherence
– conditions for Interference of light

**Interference by division of wave front:** Fresnel’s biprism – determination of wave
length of light. Determination of thickness of a transparent material using Biprism –
change of phase on reflection – Lloyd’s mirror experiment.

**Interference by division of amplitude:** Oblique incidence of a plane wave on a
thin film due to reflected and transmitted light (Cosine law) – Colours of thin films
 – Non reflecting films – interference by a plane parallel film illuminated by a point
source – Interference by a film with two non-parallel reflecting surfaces (Wedge
shaped film) – Determination of diameter of wire-Newton’s rings in reflected light
with and without contact between lens and glass plate, Newton’s rings in
transmitted light (Haidinger Fringes) – Determination of wave length of
monochromatic light – Michelson Interferometer – types of fringes – Determination
of wavelength of monochromatic light, Difference in wavelength of sodium D₁,D₂
lines and thickness of a thin transparent plate.
10 Diffraction: (10)


Fresnel diffraction:-

Fresnel’s half period zones – area of the half period zones –zone plate – Comparison of zone plate with convex lens – Phase reversal zone plate – diffraction at a straight edge – difference between interference and diffraction.

11 Polarization (10)

Polarized light : Methods of Polarization, Polarization by reflection, refraction, Double refraction, selective absorption, scattering of light – Brewsters law – Malus law – Nicol prism polarizer and analyzer – Refraction of plane wave incident on negative and positive crystals (Huygen’s explanation) – Quarter wave plate, Half wave plate – Babinet’s compensator – Optical activity, analysis of light by Laurent’s half shade polarimeter.

12 Laser, Fiber Optics and Holography: (10)


Fiber Optics: Introduction – Optical fibers – Types of optical fibers – Step and graded index fibers – Rays and modes in an optical fiber – Fiber material – Principles of fiber communication (qualitative treatment only) and advantages of fiber communication.


NOTE: Problems should be solved at the end of every chapter of all units.
Textbooks

2. **Optics** by Subramaniyam and Brijlal. *S. Chand & Co.*
5. **Second Year Physics – Telugu Academy.**

Reference Books

Unit – I  

1. **Electrostatics (10 periods)**

Gauss law and its applications-Uniformly charged sphere, charged cylindrical conductor and an infinite conducting sheet of charge. Deduction of Coulomb’s law from Gauss law Mechanical force on a charged conductor Electric potential – Potential due to a charged spherical conductor, electric field strength from the electric dipole and an infinite line of charge. Potential of a uniformly charged circular disc.

2. **Dielectrics (5 periods)**

An atomic view of dielectrics, potential energy of a dipole in an electric field. Polarization and charge density, Gauss’s law for dielectric medium– Relation between D,E, and P. Dielectric constant, susceptibility and relation between them. Boundary conditions at the dielectric surface. Electric fields in cavities of a dielectric-needle shaped cavity and disc shaped cavity.

3. **Capacitance (8 periods)**

Capacitance of concentric spheres and cylindrical condenser, capacitance of parallel plate condenser with and without dielectric. Electric energy stored in a charged condenser – force between plates of condenser, construction and working of attracted disc electrometer, measurement of dielectric constant and potential difference.

Unit – II  

1. **Magnetostatics (6 periods)**

Magnetic shell – potential due to magnetic shell – field due to magnetic shell – equivalent of electric circuit and magnetic shell – Magnetic induction (B) and field (H) – permeability and susceptibility – Hysteresis loop.

2. **Moving charge in electric and magnetic field (8 periods)**

Hall effect, cyclotron, synchrocyclotron and synchrotron – force on a current carrying conductor placed in a magnetic field, force and torque on a current loop, Biot –Savart’s law and calculation of B due to long straight wire, a circular current loop and solenoid.
3. Electromagnetic induction (10 periods)


Unit – III 20 hrs

1. Varying and alternating currents (10 periods)


2. Maxwell’s equations and electromagnetic waves (10 periods)

- A review of basic laws of electricity and magnetism – displacement current – Maxwell’s equations in differential form – Maxwell’s wave equation, plane electromagnetic waves – Transverse nature of electromagnetic waves, Poynting theorem, production of electromagnetic waves (Hertz experiment)

Unit – IV 23 hrs

1. Basic Electronics (15 periods)

- Formation of electron energy bands in solids, classification of solids in terms of forbidden energy gap. Intrinsic and extrinsic semiconductors, Fermi level, continuity equation – p-n junction diode, Zener diode characteristics and its application as voltage regulator. Half wave and full wave rectifiers and filters, ripple factor (quantitative) – p n p and n p n transistors, current components in transistors, CB,CE and CC configurations – transistor hybrid parameters – determination of hybrid parameters from transistor characteristics – transistor as an amplifier — concept of negative feed back and positive feed back – Barkhausen criterion, RC coupled amplifier and phase shift oscillator (qualitative).

2. Digital Principles (8 periods)

- Binary number system, converting Binary to Decimal and vice versa. Binary addition and subtraction (1’s and 2’s complement methods). Hexadecimal number system. Conversion from Binary to Hexadecimal – vice versa and Decimal to Hexadecimal vice versa.

- Logic gates: OR, AND, NOT gates, truth tables, realization of these gates using discrete components. NAND, NOR as universal gates, Exclusive – OR gate, De Morgan’s Laws – statement and proof, Half and Full adders. Parallel adder circuits.

NOTE: Problems should be solved from every chapter of all units.
Textbooks

1. **Modern Physics** by R. Murugeshan and Kiruthiga Siva Prasath – *S. Chand & Co.* for semiconductor & Digital Principles)

Reference Books

4. **Third year Physics** – *Telugu Akademy*
5. **Principles of Electronics** by V.K. Mehta – *S. Chand & Co.*
Unit – I: 25 hrs

Atomic Spectra


Molecular Spectroscopy:


Unit – II: 25 hrs

Quantum Mechanics

Inadequacy of classical Physics: (Discussion only)


Matter Waves:


Uncertainty Principle:


Schrodinger Wave Equation:
Schrodinger time independent and time dependent wave equations. Wave function properties – Significance. Basic postulates of quantum mechanics. Operators, eigen functions and eigen values, expectation values. Application of Schrodinger wave equation to particle in one and three dimensional boxes, potential step and potential barrier.

Unit – III 15 hrs

Nuclear Physics

Nuclear Structure:

Basic properties of nucleus – size, charge, mass, spin, magnetic dipole moment and electric quadrupole moment. Binding energy of nucleus, deuteron binding energy, p-p and n-p scattering (concepts), nuclear forces. Nuclear models – liquid drop model, shell model.


Nuclear Reactions: Types of nuclear reactions, channels, nuclear reaction kinematics. Compound nucleus, direct reactions (concepts).

Nuclear Detectors – GM counter, proportional counter, scintillation counter, Wilson cloud chamber and solid state detector

Unit – IV 25 hrs

Solid State Physics


Superconductivity:

Basic experimental facts – zero resistance, effect of magnetic field, Meissner effect, persistent current, Isotope effect Thermodynamic properties, specific heat, entropy. Type I and Type II superconductors.

Elements of BCS theory-Cooper pairs. Applications. High temperature superconductors (general information)

NOTE: Problems should be solved from every chapter of all units.

Textbooks

7. Third Year Physics - Telugu Academy.

Reference Books

Practical Paper – I

FIRST YEAR PRACTICALS

1. Study of a compound pendulum determination of ‘g’ and ‘k’.
2. Study of damping of an oscillating disc in Air and Water logarithmic decrement.
4. Study of oscillations of a mass under different combination of springs.
5. ‘Y’ by uniform Bending (or) Non-uniform Bending.
6. Verification of Laws of a stretched string (Three Laws).
7. Moment of Inertia of a fly wheel.
10. ‘n’ by torsion Pendulum.
11. Observation of Lissajous figures from CRO.
12. Study of flow of liquids through capillaries.
13. Determination of Surface Tension of a liquid by different methods.
14. Study of Viscosity of a fluid by different methods.
15. Volume Resonator – determination of frequency of a tuning fork.
16. Velocity of Transverse wave along a stretched string.
Practical Paper – II

SECOND YEAR PRACTICALS

1. Co-efficient of thermal conductivity of a bad conductor by Lee’s method.
2. Measurement of Stefan’s constant.
3. Specific heat of a liquid by applying Newton’s law of cooling correction.
5. Thickness of a wire-wedge method.
7. Determination of Radius of curvature of a given convex lens - Newton’s rings.
8. Resolving power of grating.
9. Study of optical rotation-polarimeter.
10. Dispersive power of a prism
13. Resolving power of a telescope.
14. Refractive index of a liquid and glass (Boys Method).
2. Internal resistance of a cell by potentiometer.
3. Figure of merit of a moving coil galvanometer.
5. RC circuit (Frequency response)
6. LR circuit (Frequency response)
7. LCR circuit series/parallel resonance, Q-factor
8. Power factor of an A.C. circuit
10. Design and construction of multimeter.
11. Construction of a model D.C. power supply.
12. Characteristics of a Junction diode
13. Characteristics of Transistor
14. Characteristics of Zener diode
15. Verification of Kirchoff’s laws.
1. e/m of an electron by Thomson method.
2. Energy gap of semiconductor using a junction diode
3. Temperature characteristics of thermistor
4. R.C. coupled amplifier
5. Verification of Logic gates AND, OR NOT, X-OR gates
6. Verification of De Morgan’s theorems
7. Construction and verification of truth tables for half and full adders.
8. Phase shift Oscillator
9. Hysteresis curve of transformer core
10. Determination of Planck’s constant (photocell)
11. Study of spectra of hydrogen spectrum (Rydberg constant)
12. Study of absorption of α and β rays.
15. Study of alkaline earth spectra using a concave grating.

Not for examination:

Servicing of domestic appliances – Electric Iron, immersion heater, fan, hot plate grinder, emergency lamp, battery charger, micro-oven, loud speaker, eliminator, cell-phones, servicing of refrigerator.

Suggested Books for Practicals

2. Practical Physics by M. Arul Thakpathi by *Comptek Publishers*.
3. A. Laboratory manual for Physics Course by B.P. Khandelwal.
Minutes:

After going through the Model Curriculum – Physics (UG Courses) – May 2008 received from A.P. State Council of Higher Education, all the members unanimously felt that the design of both theory and practical syllabi is based on 30 weeks of instruction (180 days). But affiliated colleges are hardly getting 150 instruction days in an academic year due to high temperature in the early days of June, heavy rains/cyclones, various bandhs, Half Yearly and Prefinal exams due to early commencement of various Practical examinations. Moreover conduct of supplementary examination in the middle of the academic year creates another havoc to complete the syllabus in time.

Syllabus needs 120 hours to complete the instruction for average students and there is no scope for extra activities like problem solving, discussions with student participation, conduct of unit tests, analyzing the previous Question papers, student lecturers etc.

NO prescription of minimum no, of practices to be arranged (or) to be completed. For some experiments, aim is specifically mentioned where as for some other experiments, it is left in vague.

Vagueness creates no, of problems in maintaining standards, Some centre try to dilute and some examiners may argue all the different aims are in syllabus.

Servicing of Micro ovens, cell phones, refrigerators require extra knowledge and hence may not be possible to take up their repair work.

Model paper for theory examinations is good.

Our scheme of valuation (practical examinations) which is in practice for the last two years is more clear and appropriate.

Resolutions:

1. Resolved to recommend for implementation of Model Curriculum regarding Physics theory papers starting from 2008-09 admitted batch of students.
2. Resolved to fix the minimum number of practical to be completed by students as 12 for Practical, I, II, III & IV.
3. Resolved to authorize the Chairman, BOS in Physics(UG) to clear the vagueness in aims of certain experiments and to make necessary arrangements to circulate the corrected syllabus for Practical, I, II, III & IV.
4. Resolved to follow the scheme of valuation with respect to Physics Practical Examinations which is in practice for the last two years (copy enclosed)
5. Resolved to request the authorities to extend the last date for instruction from 6th February at least upto 28th February, so as to complete the syllabus satisfactorily.
6. Resolved to approve the with of practices for I, II, III & IV as proposed by the chairman in the meeting.
B.SC. (Physics)
Practical Paper – I

2. Damping of an oscillating disc – Logarithmic decrement.
3. Oscillations under Bifilar suspension – Moment of Inertia.
4. Combinations of springs – Verification of equations (Series & parallel)
5. Young’s Modulus – Uniform (or) non uniform bending.
7. Sonometer – Velocity of transverse wave along a stretched string.
8. Simple pendulum – Estimation of standard error
10. Fly wheel – Moment of Inertia
11. Study of flow of liquids through Capillaries.
12. Viscosity of a fluid by any one method.
13. Surface tension of a liquid by any one method.
15. Volume resonator – frequency a unity fork using V-i/n2 graph.
16. Lissajous figures using CRO (demonstration expt.)
*Minimum 12 experiments one to be completed by the student out of 15 experiments arranged.

B.Sc. (Physics) – Practical – II

1. Lee’s method – Co-efficient of thermal conductivity of a bad conductor.
2. Determination of stefan’s constant.
5. Diameter of athinwire-Wedge method.
6. Wave length of light – Biprison
8. Resolving power of grating.
10. Dispersive power of a prism.
13. Resolving power of a telescope.
15. Wave length of laser light using diffraction grating.

Minimum 12 experiments are to be completed by the student out of 15 experiments arranged.
B.Sc. (Physics)

Practical – III

1. Potent meter – calibration of a Volt meter (high range)
2. Potations meter – Internal resistance of a cell.
3. Carry Foster’s Bridge – Comparison of resistances.
4. Carry Foster’s Bridge – Temperature coefficient of resistance.
5. Figure of merit of a moving coil galvanometer.
8. Ballistic galvanometer – Self/Mutual inductance determination.
11. LCR – Series/parallel resonance, Q-factor.
13. Determination of A.C. Frequency – Sonometer
14. Temperature characteristics of thermistor
15. Verification of Kickoff’s Laws.
16. Study of magnetic field along the axis of a current carrying circular coil.

- Minimum 12 experiments are to be completed by the student out of 15 experiments arranged.

B.Sc. (Physics)

Practical – IV

2. Characteristics of Zener Diode.
3. Construction of model power supply – study of its load characteristics.
5. R.C. coupled amplifier – frequency determination.
6. Phase shift oscillator – frequency determination.
8. Hysteretic curve – estimate of energy loss per cycle.
9. AND, OR, X-OR, NOT, NOR, N XOR gates – Truth table Verification
11. Verification of DeMorgan’s Thers.
12. Construction of half and full address – Trugh table Verification.
14. e/m of an electron by Thomson meter/Helical method.
17. Absorption spectrum of iodine vapour.
18. Study of alkaline earth specific using concave grating.

Not for examination:

Suggested Books for Practicals:

2. Practical Physics by M.ARul Thakpathi by Comptex Publishers.
3. A. Laboratory manual for Physics Course by B.P. Khandelwal.
Practical Examination – Scheme of Valuation and other guidelines.

**Max: Marks:** 50 (For Record 10: For Practical Exam: 40)

Record valuation is to be divided into two parts.

i) Basing on No. of experiments recorded award a maximum of 4 marks, as per the following table.

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ii) Basing on Quality of practical Work recorded i.e. by considering procedure adopted, sketch of apparatus, correctness of observations and result, quality of graphs drawn and neatness of the record – Award 6 marks.

For practical examination – 40 marks:

- Circuit diagram and formula with explanation of symbols used -5 marks
- Circuit connections / arrangement of apparatus -5 marks
- Tabular form and procedure adopted -5 marks
- Observations -10 marks
- Calculations and graphs -6 marks
- Result and units -4 marks
- Viva voce -5 marks

Total marks -40 marks

- One or two questions are to be assigned to each candidate taking the duration of practical exam into consideration,
- Four or five question are to be arranged for each batch basing on available number of sets of equipment.
- All the 12 experiments are to be covered at any centre for any class.
- Non-programmable calculations are allowed for calculation work.
- Viva-Voice is to be conducted for every candidate pertaining to the question allotted.
- Examiner is entitled to reject any number of recorded practical’s under valued reasons.
- Penalty for change of experiment in practical examinations.

i) In case of not recorded one - No Penalty
ii) In case of recorded one - 1/3 marks of candidate’s score
   Out of 40 marks are to deducted.